APPENDIX M
CONSTRUCTION CONSIDERATIONS

The primary concerns about construction's impact on fish habitat involve potential creation of passage barriers, release of sediment or pollutants, and removal of stream bank vegetation.

NOTE: The material presented in this Appendix is extracted from the *Fish Habitat Manual* (Alberta Transportation, n.d.) and from the *California Salmonid Stream Habitat Restoration Manual* (CDFG 2003).

M.1. Instream Work

- Plan the project so that the amount of instream work is kept to a minimum
- Where possible, plan instream work to occur as a single event
- Restrict instream work to low flow periods where possible
- Restrict instream work to the dry period if the channel is seasonally dry
- Limit machinery access to a single point on one bank
- Prior to construction, determine locations and equipment access points that minimize riparian disturbance. Avoid affecting less stable areas.
- Limit distance between the machinery access point and work site
- Adhere to timing restrictions
- Minimize flow constriction
- Consider an instream pad built of washed gravel where instream equipment activity would generate excess sediment
- Fish rescue

M.1.1. General Work Area

- Keep right-of-way for channel crossings as narrow as possible within the constraints of safety and construction requirements
- Limit removal of vegetation to the width of the right-of-way. Retain as much understory brush and as many trees as feasible, emphasizing shade-producing and bank-stabilizing vegetation.
- Clear vegetation by hand from unstable banks subject to erosion, avoiding the use of heavy machinery
- Develop sediment control plans and install sediment control measures before starting work
- Stockpile topsoil removed from the right-of-way outside of the active floodplain and use measures such as silt fences and holding ponds to prevent stockpile runoff from entering the stream channel
- Minimize temporary stockpiling of excavated material
- Direct runoff containing sediment away from the stream into a vegetated area
- Construct suitably sized settling ponds to precipitate suspended sediment before water is discharged into the stream channel
- Stabilize soils subject to erosion as soon as practical by seeding, spreading mulch, or installing erosion control blankets
- Allow at least four weeks of growing season when using seeding to stabilize soils subject to erosion
- Maintain a vegetated buffer strip between the work site and stream channel except at the actual crossing location

Machinery

- Ensure that machinery arrives onsite washed, clean, and in good working condition, showing no signs of fuel or oil leaks
- Install stabilized entrances at vehicle and machinery access points
- Limit the amount and duration of instream work with heavy machinery. Work from the banks where possible.
- Minimize soil compaction by using equipment with a greater reach or that exerts less pressure per square inch on the ground, resulting in less overall area disturbed or less compaction of disturbed areas.
- Locate areas for fuel storage, refueling, and servicing of construction equipment in an upland location well removed from the stream channel
- Wash and service vehicles and machinery at locations well removed from the stream channel
- Work on instream pads composed of washed gravel to minimize sediment entrainment

Potentially Toxic Materials

- Prevent any construction debris from falling into the stream channel. Remove any material that does fall into a stream during construction in a manner that has minimal impact to the streambed and water quality.
- Use bio-friendly hydraulic fluids in equipment operating in or adjacent to the stream. If riparian vegetation is to be removed with chainsaws, consider using saws currently available that operate with vegetable-based bar oil.
- Store fuel, lubricants, hydraulic fluid and other potentially toxic materials at locations well removed from the stream channel
- Isolate storage areas so that spilled fluids cannot enter the stream
- Prepare a spill contingency plan
- Maintain spill cleanup supplies onsite and be knowledgeable in their proper use and deployment
- In the event of a spill, immediately cease work, start cleanup, and notify the appropriate authorities
- Ensure treated lumber is completely dry (no evidence of treatment material seepage) before use in or near the stream
- Treat or paint lumber used in construction at a site well removed from the stream
- Use bridge skirts or other appropriate measures to prevent material from entering the stream channel when painting, cleaning, or resurfacing bridge deck and superstructures
- Do not use ammonium nitrate fuel oil-based explosives
- Do not allow petroleum products, fresh cement, or deleterious materials to enter the stream channel

Cofferdams and Berms

- Use cofferdams (earth fill, sheet pile, or other proprietary designs) to separate instream work site from flowing water
- Use clean, washed material for construction and face berms with clean granular material

- Design cofferdams to accommodate the expected flows of the stream
- Limit cofferdams to one side of the stream channel at any one time and ensure that they block no more than one-third of the channel
- Restore the original channel bottom grade after removing cofferdams
- Treat all water pumped from behind the cofferdams to remove sediment before discharge

Temporary Diversion Channels

- Construct temporary diversion channels "in the dry", starting from the downstream end
- Design temporary diversion channels to accommodate expected flow from storm events
- Use erosion control methods where appropriate. Maintain erosion control measures in place at all times during construction.
- Maintain a supply of erosion control materials onsite to facilitate a quick response to unanticipated storm events or emergencies
- Leave the existing channels untouched until the temporary diversions are constructed and erosion protection is in place
- Open diversion channels from the downstream end first
- Use clean, washed material to close existing channels and divert water to temporary diversion channels
- Use gradient controls to ensure that diversion channel slopes correspond to the existing channel gradients
- Protect unstable bends from erosion

Pumped Diversions/Dewatering

- Use only where a channel must be completely blocked to allow work "in the dry". Do not use at a time when there are fish passage concerns.
- Prior to dewatering, determine the best means to bypass flow through the work area to minimize disturbance to the channel and to avoid mortality of fish and other aquatic vertebrates
- Coordinate project site dewatering with a fisheries biologist. Fish relocation activities must be performed only by qualified fisheries biologists in possession of the requisite permits.
- Minimize the length of the dewatered stream channel and duration of dewatering
- Bypass stream flow around work area, but maintain stream flow to channel below construction site
- Size and screen intakes to prevent debris blockage and fish mortality
- Size the pumping system to accommodate expected flow from storm events
- When periodically pumping seepage from the work area, place pumps in flat areas well away from the stream channel. Secure pumps by tying off to a tree or stake in place to prevent movement by vibration. Refuel in area well away from stream channel and place fuel-absorbent mats under pump while refueling. Cover pump intakes with 1/8-inch mesh to prevent entrainment of any fish or amphibians that were not previously removed. Check intakes periodically for impingement of fish or amphibians.

- Discharge wastewater from construction area to an upland location where it will not drain sediment-laden water back to the stream channel
- Armor the discharge point with clean rock to prevent erosion

Reclamation and Site Cleanup

- Begin reclamation and site cleanup as soon as construction has been completed
- Decompact disturbed soils at project completion as the heavy equipment exits the construction area
- Remove all waste material from active floodplain
- Remove all temporary fill in its entirety prior to close of work window
- Re-contour, stabilize, and re-vegetate disturbed areas to suit original conditions. Stabilize all exposed soil with mulch, seeding, and/or by placement of erosion control blankets.
- Re-vegetate disturbed and decompacted areas with native species specific to the project location. The native species should encompass a diverse community of woody and herbaceous species.
- Remove all temporary facilities and structures
- Stabilize all slopes leading directly to the stream channel
- Seed exposed slopes immediately if there are at least four weeks remaining in the growing season. If this is not possible, immediately re-vegetate slopes in the next growing season.

M.1.2. Construction Bid Period and Completion

It is important that the designers be part of the bid evaluation and construction process to assure the intent of the design is carried through the selection process and construction activities. Understanding by the contractor of the bid requirements, and the construction means and methods, relative to the fish passage design intent is necessary to minimize any misunderstandings or misconceptions.